PATENT COOPERATION TREATY

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REC'D 19 JUN 2006
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INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference	FOR FURTHER ACTION	See Form PCT/IPEA/416
RL.P53006WO		
International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/EP2004/050229	27.02.2004	
International Patent Classification (IPC) or national classification and IPC		
INV. H04L1/00		
Applicant		
TELEFONAKTIEBOLAGET L M ERICSSON (PUBL) et al.		

1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 5 sheets, including this cover sheet.
3. This report is also accompanied by ANNEXES, comprising:
   a. ☒ *sent to the applicant and to the International Bureau)* a total of 6 sheets, as follows:
      ☒ sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).
      ☐ sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.
   b. ☐ *(sent to the International Bureau only)* a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing and/or tables related thereto, in electronic form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).

4. This report contains indications relating to the following items:

☒	Box No. I	Basis of the report
☐	Box No. II	Priority
☐	Box No. III	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
☐	Box No. IV	Lack of unity of invention
☒	Box No. V	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
☐	Box No. VI	Certain documents cited
☐	Box No. VII	Certain defects in the international application
☐	Box No. VIII	Certain observations on the international application

Date of submission of the demand	Date of completion of this report
22.12.2005	19.06.2006

Name and mailing address of the international preliminary examining authority:	Authorized officer
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INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.
PCT/EP2004/050229

Box No. I Basis of the report

1. With regard to the **language**, this report is based on

   ☒ the international application in the language in which it was filed

   ☐ a translation of the international application into , which is the language of a translation furnished for the purposes of:
   - ☐ international search (under Rules 12.3(a) and 23.1(b))
   - ☐ publication of the international application (under Rule 12.4(a))
   - ☐ international preliminary examination (under Rules 55.2(a) and/or 55.3(a))

2. With regard to the **elements*** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:

Description, Pages	
1, 5-18	as originally filed
2-4, 4a	filed with telefax on 01.06.2006
Claims, Numbers	
1-6	filed with telefax on 01.06.2006
Drawings, Sheets	
1/2, 2/2	as originally filed

   ☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing

3. ☐ The amendments have resulted in the cancellation of:
   - ☐ the description, pages
   - ☐ the claims, Nos.
   - ☐ the drawings, sheets/figs
   - ☐ the sequence listing *(specify)*:
   - ☐ any table(s) related to sequence listing *(specify)*:

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).
   - ☐ the description, pages
   - ☐ the claims, Nos.
   - ☐ the drawings, sheets/figs
   - ☐ the sequence listing *(specify)*:
   - ☐ any table(s) related to sequence listing *(specify)*:

* *If item 4 applies, some or all of these sheets may be marked "superseded."*

Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1-6
	No:	Claims	
Inventive step (IS)	Yes:	Claims	1-6
	No:	Claims	
Industrial applicability (IA)	Yes:	Claims	1-6
	No:	Claims	

2. Citations and explanations (Rule 70.7):

see separate sheet

Re Item V

Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Reference is made to the following documents:
   D1: US 2003/117972 A1 (VIMPARI MARKKU) 26 June 2003 (2003-06-26)

2. Document D1, which is considered at present to represent the most relevant state of the art, discloses (Fig 2) a method for optimising bandwidth usage on a real time protocol (RTP) managed link of a cellular telecommunications network wherein the rate of packet loss of said link is monitored to determine whether the rate of packet loss is unacceptably high or within acceptable limits. As a result of said monitoring the sending rate over the link is adapted by repacketising media received at the node from third party nodes.

3. The subject-matter of claims 1 and 6 differs from the disclosure of document D1 in the following:

   the size of packets sent over the link is increased when the rate of packet loss is unacceptably high, thereby reducing packet header overhead and reducing bandwidth usage on the link; or the size of packets sent over the link is decreased when the rate of packet loss is within acceptable limits, thereby reducing the transmission delay over the link.

4. **The subject-matter of claims 1 and 6 is therefore new (Article 33(2) PCT).**

5. The problem to be solved by the present invention is packet loss reduction and managing the trade-off between packet loss and delay.
   The present invention attempts to reduce packet loss by reducing bandwidth usage over the link when an unacceptably high packet loss is detected. This is accomplished by reducing the portion of bandwidth used with header overhead by repacketising media in larger packets. Otherwise, if packet loss is acceptable, the invention attempts to reduce delay by repacketising media in smaller packets.

6. The solution to this problem proposed in claims 1 and 6 of the present application is **considered as involving an inventive step (Article 33(3) PCT)** for the following reasons:

The known way to adapt packet size to loss rates is to reduce the packet size when the loss rates increase. This is the approach used in document D1, for example. Such approach gives more importance to the individual call or connection rather than to the link as a whole, as it does not to reduce bandwidth usage in the link, but intends primarily to reduce the delay and the probability of error for packets in the adapted connection or call. Therefore, the prior art does not suggest the solution presented in the independent claims.

7. Claims 2-5 are dependent on claim 1 and as such also meet the requirements of the PCT with respect to novelty and inventive step.

P. Borges

The Real time Transport Protocol (RTP) is an Internet protocol standard that defines a way for applications to manage the real-time transmission of multimedia data. RTP is used at the bearer or media level (as opposed to the call control level which employs SIP or other call control protocol) for Internet telephony applications including VoIP. RTP does not guarantee real-time delivery of multimedia data, as this is dependent on the actual network characteristics. RTP provides the functionality to manage the data as it arrives to best effect. User Plane Adaptation (UPA) is the procedure used by the MRF and a given UE to monitor the RTP traffic between them and to adjust bandwidth utilisation in an attempt to provide optimal quality during a talk session. UPA provides for the MRF to dynamically redefine the talk burst duration which is encapsulated in a given RTP packet on a given link (this parameter is known as *ptime*) and the codec used for that link (the codec is identified by one of a number of parameters contained in a "mode set"). The SIP message reINVITE/UPDATE is used to signal these parameters to the UE. The UE may also send this message to the MRF in order to notify the MRF of its capabilities/requirements.

The group know as the Open Mobile Alliance has developed a Push to talk Over Cellular (PoC) specification aimed at enabling the provision of services over standard mobile networks which resemble walkie-talkie services, i.e. at the push of a button a subscriber can be instantly connected to one or more other subscribers. PoC relies upon the MRF to set up and handle connections. The PoC specification describes the tools available to detect packet loss over the links between the MRF and individual UEs. PoC also describes a means to request a change in bandwidth utilization, but does not provide detailed algorithms or procedures to enable this.

Summary of the Invention

According to a first aspect of the present invention there is provided a method of optimising the bandwidth usage on a Real-Time Protocol managed link transporting media from a Media Resource Function of a cellular telecommunications network to User Equipment, the method comprising:

ved at the EPO on Jun 01, 2006 15:18:53. Page 3 of 15

monitoring the rate of packet loss of the link to determine whether the rate of packet loss is unacceptably high or within acceptable limits; and

as a result of said monitoring, adapting the sending rate over the link by re-packetising media, received at the Media Resource Function from third party nodes, to either increase the size of packets sent over the link when the rate of packet loss is unacceptably high, thereby reducing packet header overhead and reducing bandwidth usage on the link; or to decrease the size of packets sent over the link when the rate of packet loss is within acceptable limits, thereby reducing the transmission delay over the link.

The invention is applicable in particular to networks in which the Media Resource Function is arranged to handle media distribution for Push-to-talk over Cellular services.

Embodiments of the present invention have the advantage that adaption on the downlink can be achieved without having to vary the packet sizes transmitted by third party nodes. Thus, transmission delays on these uplinks to the Media Resource Function are maintained at optimum levels. An additional consequential benefit is that bandwidth usage can be adapted without having to signal to other UEs. Expensive additional signalling traffic is thus avoided.

Preferably, the method comprises re-packetising received media only into packet sizes which are larger than the packet sizes in which the media is received at the Media Resource Function.

Typically, the step of monitoring the rate of packet loss of the link comprises sampling the rate of packet loss on the link. This may be carried out at the receiving UE, with the UE sending the samples to the Media Resource Function. The Media Resource Function adjusts the sent packet size in order to reduce the rate of packet loss on the link or to decrease the transmission delay. In particular, when the rate of packet loss is unacceptably high, the Media Resource Function may re-packetise incoming media into larger packets, thereby reducing the packet header overhead and reducing the bandwidth usage on the downlink. When the rate of packet loss is within acceptable limits, the

incoming media may be re-packetised to reduce the packet size, thereby reducing the transmission delay over the link.

It will be appreciated that said step of adapting the sending rate is carried out dynamically in response to the monitored rate of packet loss.

Preferably, in the event that media is to be repacketised at the Media Resource Function, received media is stored at the Media Resource Function in a buffer until such time as sufficient media has been received to construct a packet of the necessary size.

Said third party nodes are typically peer User Equipment (UEs), although they may be other nodes such as web servers, etc.

According to a second aspect of the present invention there is provided a Media Resource Function node for use in a cellular telecommunications network, the node handling media sent between itself and user equipment over a Real-Time Protocol managed link, the node comprising:

means for monitoring the rate packet loss of the downlink to the User Equipment to determine whether the rate of packet loss is unacceptably high or within acceptable limits; and

means for adapting, based upon the monitored packet loss, the sending rate over the link by re-packetising media received from third party nodes, to increase the size of packets sent over said downlink when the rate of packet loss is unacceptably high, thereby reducing packet header overhead and reducing bandwidth usage on the link, or to decrease the size of packets sent over the link when the rate of packet loss is within acceptable limits, thereby reducing the transmission delay over the link.

Brief Description of the Drawings

Figure 1 illustrates schematically the architecture of a cellular telecommunications network employing a MRF node to coordinate VoIP voice conferencing; and
Figure 2 is a flow diagram illustrating a method for adapting bandwidth usage on a link of a VoIP voice conference.

Detailed Description of Certain Embodiments

Considering now in detail the PoC service, a single MRF can manage thousands of talk sessions, with each session being independent from other sessions that may be hosted by the same MRF. A given talk session will comprise two or more pieces of user equipment (UE) and the central MRF. These UEs might each have different capabilities. Talk bursts from a UE are encoded and sent to the MRF (via respective GGSNs) as one or more RTP packets, referred to here as simply "packets". The MRF then forwards the packets to the or each other UE participating in the same talk session. The path which the packets take from the UE to the MRF is called the "uplink". The

Claims

1. A method of optimising the bandwidth usage on a Real-Time Protocol managed link transporting media from a Media Resource Function of a cellular telecommunications network to User Equipment, the method comprising:

monitoring the rate of packet loss of the link to determine whether the rate of packet loss is unacceptably high or within acceptable limits; and

as a result of said monitoring, adapting the sending rate over the link by re-packetising media, received at the Media Resource Function from third party nodes, to either increase the size of packets sent over the link when the rate of packet loss is unacceptably high, thereby reducing packet header overhead and reducing bandwidth usage on the link; or to decrease the size of packets sent over the link when the rate of packet loss is within acceptable limits, thereby reducing the transmission delay over the link.

2. A method according to claim 1, wherein the step of monitoring the rate of packet loss of the link comprises sampling.

3. A method according to claim 1 or 2, wherein said step of adapting the sending rate is carried out dynamically in response to the monitored rate of packet loss.

4. A method according to any one of the preceding claims, wherein, in the event that media is to be repacketised at the Media Resource Function, received media is stored at the Media Resource Function in a buffer until such time as sufficient media has been received to construct a packet of the necessary size.

5. A method according to any one of the preceding claims, wherein said third party nodes are peer User Equipment (UEs).

6. A Media Resource Function node for use in a cellular telecommunications network, the node handling media sent between itself and user equipment over a Real-Time Protocol managed link, the node comprising:

means for monitoring the rate of packet loss of the downlink to the User Equipment to determine whether the rate of packet loss is unacceptably high or within acceptable limits; and

means for adapting, based upon the monitored properties, the sending rate over the link by re-packetising media received from third party nodes, to increase the size of packets sent over said downlink when the rate of packet loss is unacceptably high, thereby reducing packet header overhead and reducing bandwidth usage on the link; or to decrease the size of packets sent over the link when the rate of packet loss is within acceptable limits, thereby reducing the transmission delay over the link.